Laboratory work 1

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Additional sorry for making this so lame-like. It is first time I see jupyter and it is 5 minutes since I saw markdowns. So far I don't even see what parts of the code should be commented more, so I am hoping I will get better at it.

In [51]:
```
# 1. imports
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
```

In [52]:
```
# 2. upload the dataset
dataset = pd.read_csv('diabetes.csv')
```

In [53]:
```
# 3. explore dataset
dataset.describe()
```

Out[53]:

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction	Age	Outcome
count	768.000000	768.000000	768.000000	768.000000	768.000000	768.000000	768.000000	768.000000	768.000000
mean	3.845052	120.894531	69.105469	20.536458	79.799479	31.992578	0.471876	33.240885	0.348958
std	3.369578	31.972618	19.355807	15.952218	115.244002	7.884160	0.331329	11.760232	0.476951
min	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.078000	21.000000	0.000000
25%	1.000000	99.000000	62.000000	0.000000	0.000000	27.300000	0.243750	24.000000	0.000000
50%	3.000000	117.000000	72.000000	23.000000	30.500000	32.000000	0.372500	29.000000	0.000000
75%	6.000000	140.250000	80.000000	32.000000	127.250000	36.600000	0.626250	41.000000	1.000000
max	17.000000	199.000000	122.000000	99.000000	846.000000	67.100000	2.420000	81.000000	1.000000

In third task there are obviously too many zeroes that showed up.

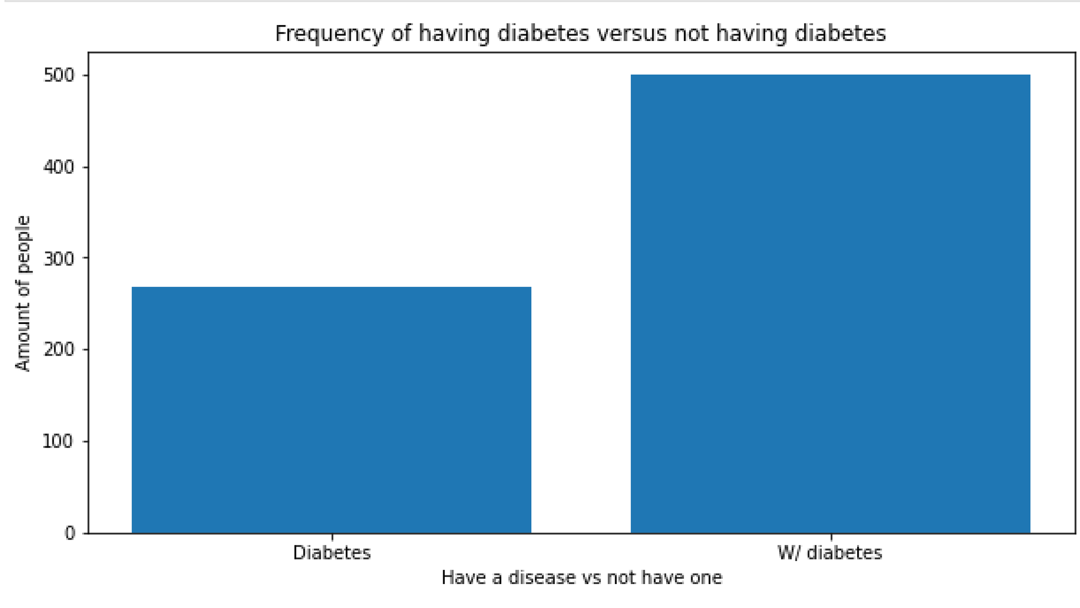
In [54]:
```
# 4. list variable names
dataset.columns.tolist()
```

Out[54]:
```
['Pregnancies',
 'Glucose',
 'BloodPressure',
 'SkinThickness',
 'Insulin',
 'BMI',
 'DiabetesPedigreeFunction',
 'Age',
 'Outcome']
```

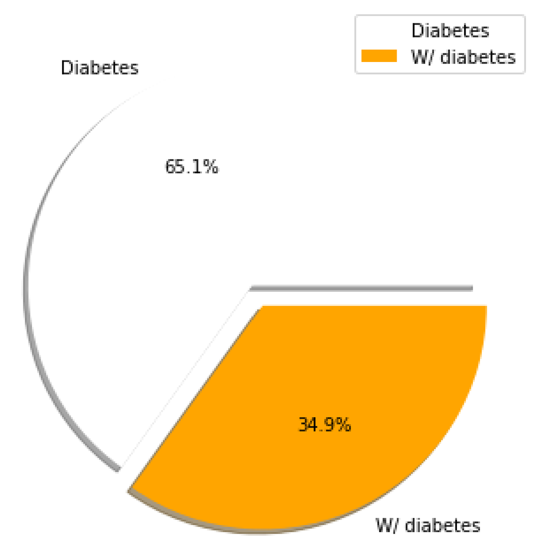
In [55]:
```
# 5. count how many have diabetes and how many don't
value_counts = dataset.Outcome.value_counts()
print('Diabetes counts: ')
print(str(value_counts))
```

```
Diabetes counts:
0    500
1    268
Name: Outcome, dtype: int64
```

In [56]:
```
# 6. Create a bar chart to represent the frequencies of those with diabetes versus those without diabetes,
# label the axes and name the chart.
not_diabetes = value_counts[0]
diabetes = value_counts[1]
diabetes_havers_labels = ['Diabetes', 'W/ diabetes']
plt.bar(diabetes_havers_labels, [diabetes, not_diabetes])
plt.title('Frequency of having diabetes versus not having diabetes')
plt.xlabel('Have a disease vs not have one')
plt.ylabel('Amount of people')
plt.show()
```



In [57]:
```
# 7. Create a pie plot, change the colors, add the labels, add shade, and 'explode' the pie slice for those tha
# Create the legend and put it into the right corner so that it does cover the pie plot.
pie_colors = ['white', 'orange']
plt.pie(value_counts, labels=diabetes_havers_labels, colors=pie_colors, explode=[0, 0.1], shadow=True, autopct=
# matplotlib.rcParams['text.color'] = 'white' # for dark theme..
plt.legend()
plt.legend(loc="upper right")
plt.subplots_adjust(left=0.01, bottom=0.001, right=0.75)
plt.show()
```



In [58]:
```
# 8. Calculate and report the mean the standard deviation of the BMI variable.
bmi_mean = dataset.BMI.mean()
bmi_std = dataset.BMI.std()
print('BMI mean: ' + str(bmi_mean))
print('BMI standard deviation: ' + str(bmi_std))
```

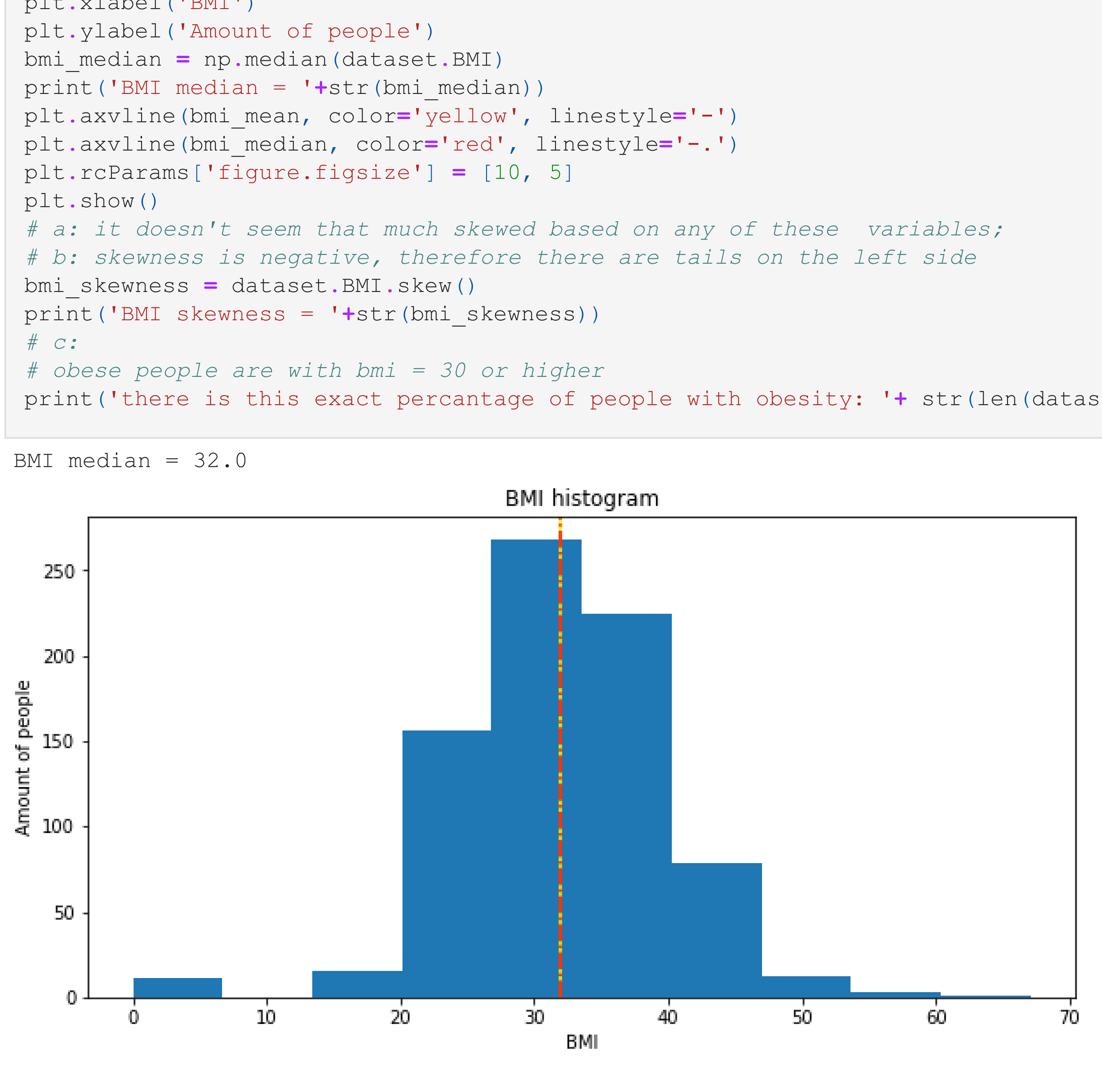
```
BMI mean: 31.992578124999998
BMI standard deviation: 7.884160320375446
```

In [59]:
```
# 9. By using the Chebysheffs Theorem infer what is the range for the BMI variable for 75% of the people in you
#  What is the range for 89% of the people in your dataset.
# 1) mean - (lower boundary) = within number
# 2) mean - (upper boundary) = within number
#  k - number of standard deviations
#  k = the within number / std
# wn = sqrt(1/(1-x))* std; x = percentage
wn75 = np.sqrt(1/(1 - 75/100)) * bmi_std
wn89 = np.sqrt(1/(1 - 89/100)) * bmi_std
print(wn75)
print('range for 75% is between '+ str(bmi_mean - wn75) + ' and ' + str(bmi_mean + wn75))
print(wn89)
print('range for 89% is between '+ str(bmi_mean - wn89) + ' and ' + str(bmi_mean + wn89))
```

```
15.768320640750892
range for 75% is between 16.224257484249108 and 47.76089876575089
23.771637790630525
range for 89% is between 8.220940334369473 and 55.76421591563052
```

In [60]:
```
# 10. Create a histogram for the BMI variable, plot the mean and meadian on the historgram to answer the follow
# a)    Is the BMI distribution skewed based on the position of the mean versus the median?
# b)    Calculate the skewness of BMI
# c)    Based on the value of BMI median and on the chart below infer what percentage of people in your dataset
# create histogram
plt.hist(dataset.BMI)
plt.title('BMI histogram')
plt.xlabel('BMI')
plt.ylabel('Amount of people')
bmi_median = np.median(dataset.BMI)
print('BMI median = '+str(bmi_median))
plt.axvline(bmi_mean, color='yellow', linestyle='-')
plt.axvline(bmi_median, color='red', linestyle='-.')
plt.rcParams['figure.figsize'] = [10, 5]
plt.show()
# a: it doesn't seem that much skewed based on any of these  variables;
# b: skewness is negative, therefore there are tails on the left side
bmi_skewness = dataset.BMI.skew()
print('BMI skewness = '+str(bmi_skewness))
# c:
# obese people are with bmi = 30 or higher
print('there is this exact percantage of people with obesity: '+ str(len(dataset.BMI[dataset.BMI >= 30])/(len(d
```

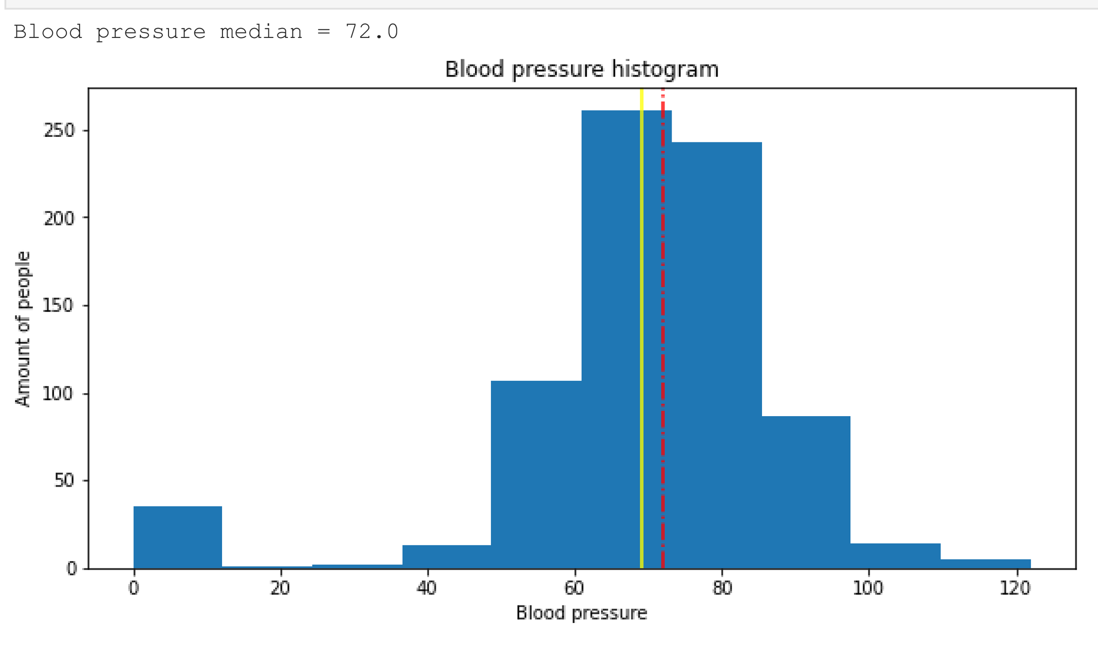
```
BMI median = 32.0
```




```
BMI skewness = -0.42898158845356543
there is this exact percantage of people with obesity: 61.458333333333336
```

In [61]:
```
# 11. doing step 10 for blood pressure
plt.hist(dataset.BloodPressure)
plt.title('Blood pressure histogram')
plt.xlabel('Blood pressure')
plt.ylabel('Amount of people')
blood_pressure_median = np.median(dataset.BloodPressure)
blood_pressure_mean = np.mean(dataset.BloodPressure)
print('Blood pressure median = '+str(blood_pressure_median))
plt.axvline(blood_pressure_mean, color='yellow', linestyle='-')
plt.axvline(blood_pressure_median, color='red', linestyle='-.')
plt.rcParams['figure.figsize'] = [10, 5]
plt.show()
# a: distribution is skewed  on the mean more it seems
# b: calculate skewness, it is negative, therefore tails are on the left, but it is also VERY big, so we should
blood_pressure_skewness = dataset.BloodPressure.skew()
print('Blood pressure skewness = '+str(blood_pressure_skewness))
# c:
# obesity is not the thing here
# I found out that with more outliers on the left the mean value became less descriptive and according to the s
# stick to the median instead
```

```
Blood pressure median = 72.0
```




```
Blood pressure skewness = -1.8436079833551302
```

In [62]:
```
# 12. Remove all the observations where the BloodPressure' and the BMI variables take the value of zero
dataset = dataset.drop(dataset[dataset.BloodPressure == 0].index) # for some reason it stopped working in one l
dataset = dataset.drop(dataset[dataset.BMI == 0].index)
dataset.describe()
```

Out[62]:

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction	Age	Outcome
count	729.000000	729.000000	729.000000	729.000000	729.000000	729.000000	729.000000	729.000000	729.000000
mean	3.858711	121.046639	72.367627	21.499314	83.946502	32.469959	0.474117	33.318244	0.344307
std	3.357468	32.255215	12.375838	15.708376	116.803000	6.885098	0.331649	11.753078	0.475468
min	0.000000	0.000000	24.000000	0.000000	0.000000	18.200000	0.078000	21.000000	0.000000
25%	1.000000	99.000000	64.000000	0.000000	0.000000	27.500000	0.245000	24.000000	0.000000
50%	3.000000	117.000000	72.000000	24.000000	46.000000	32.400000	0.378000	29.000000	0.000000
75%	6.000000	141.000000	80.000000	33.000000	130.000000	36.600000	0.627000	41.000000	1.000000
max	17.000000	199.000000	122.000000	99.000000	846.000000	67.100000	2.420000	81.000000	1.000000

In [63]:
```
# 13.8 Now perform once again all the steps in 8, 9, 10 and 11
# 8. Calculate and report the mean the standard deviation of the BMI variable.
bmi_mean = dataset.BMI.mean()
bmi_std = dataset.BMI.std()
print('BMI mean: ' + str(bmi_mean))
print('BMI standard deviation: ' + str(bmi_std))
# mean is now bigger, std is now less
```

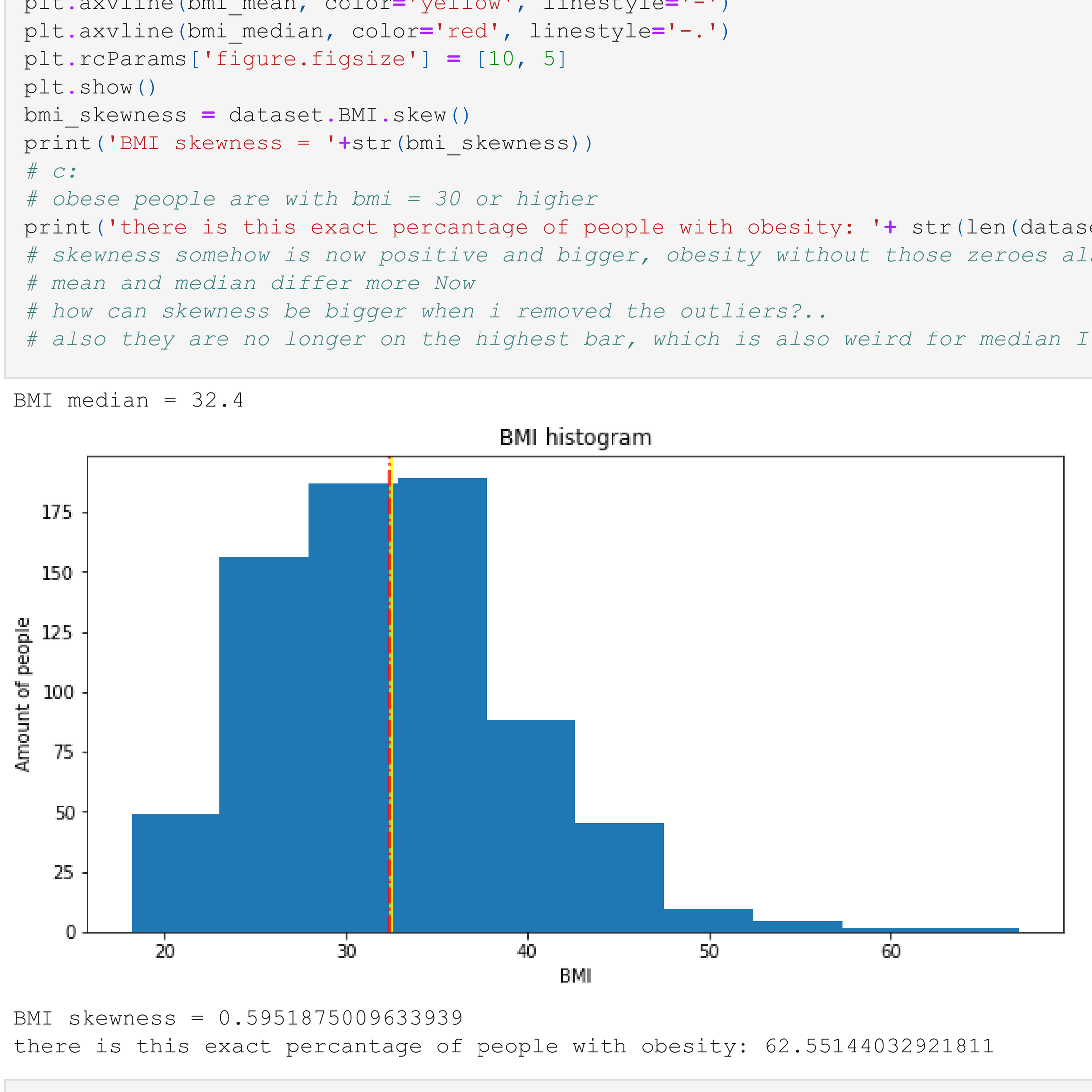
```
BMI mean: 32.46995884773663
BMI standard deviation: 6.885098188024897
```

In [64]:
```
# 13.9. By using the Chebysheffs Theorem infer what is the range for the BMI variable for 75% of the people in
#  What is the range for 89% of the people in your dataset.
# 1) mean - (lower boundary) = within number
# 2) mean - (upper boundary) = within number
#  k - number of standard deviations
#  k = the within number / std
# wn = sqrt(1/(1-x))* std; x = percentage
wn75 = np.sqrt(1/(1 - 75/100)) * bmi_std
wn89 = np.sqrt(1/(1 - 89/100)) * bmi_std
print(wn75)
print('range for 75% is between '+ str(bmi_mean - wn75) + ' and ' + str(bmi_mean + wn75))
print(wn89)
print('range for 89% is between '+ str(bmi_mean - wn89) + ' and ' + str(bmi_mean + wn89))
# as a result within numbers are smaller, the range also became smaller because zeros seemed to be just outlie
```

```
13.770196376049794
range for 75% is between 18.69976247168683 and 46.240155223786424
20.75935212221311
range for 89% is between 11.710606725523519 and 53.229310969949736
```

In [65]:
```
# 13.10. Create a histogram for the BMI variable, plot the mean and meadian on the historgram to answer the fo
# a)    Is the BMI distribution skewed based on the position of the mean versus the median?
# b)    Calculate the skewness of BMI
# c)    Based on the value of BMI median and on the chart below infer what percentage of people in your dataset
# create histogram
plt.hist(dataset.BMI)
plt.title('BMI histogram')
plt.xlabel('BMI')
plt.ylabel('Amount of people')
bmi_median = np.median(dataset.BMI)
print('BMI median = '+str(bmi_median))
plt.axvline(bmi_mean, color='yellow', linestyle='-')
plt.axvline(bmi_median, color='red', linestyle='-.')
plt.rcParams['figure.figsize'] = [10, 5]
plt.show()
bmi_skewness = dataset.BMI.skew()
print('BMI skewness = '+str(bmi_skewness))
# c:
# obese people are with bmi = 30 or higher
print('there is this exact percantage of people with obesity: '+ str(len(dataset.BMI[dataset.BMI >= 30])/(len(d
# skewness somehow is now positive and bigger, obesity without those zeroes also appears more often
# mean and median differ more Now
# how can skewness be bigger when i removed the outliers?..
# also they are no longer on the highest bar, which is also weird for median I guess
```

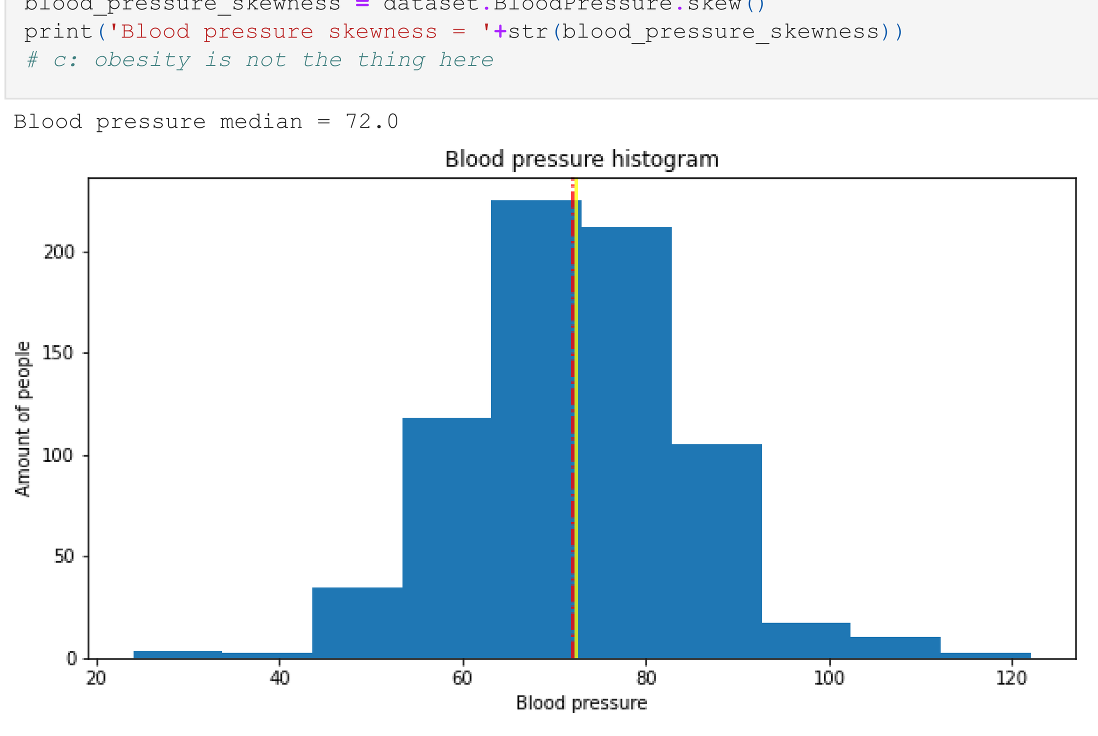
```
BMI median = 32.4
```




```
BMI skewness = 0.5951875009633939
there is this exact percantage of people with obesity: 62.55144032921811
```

In [66]:
```
# 13.11. doing step 10 for blood pressure
plt.hist(dataset.BloodPressure)
plt.title('Blood pressure histogram')
plt.xlabel('Blood pressure')
plt.ylabel('Amount of people')
blood_pressure_median = np.median(dataset.BloodPressure)
blood_pressure_mean = np.mean(dataset.BloodPressure)
print('Blood pressure median = '+str(blood_pressure_median))
plt.axvline(blood_pressure_mean, color='yellow', linestyle='-')
plt.axvline(blood_pressure_median, color='red', linestyle='-.')
plt.rcParams['figure.figsize'] = [10, 5]
plt.show()
# a: distribution is skewed  on the mean more
# b: calculate skewness, it is positive and also very small, therefore tails are on the right, so we should st
#  skewness is pretty small here
blood_pressure_skewness = dataset.BloodPressure.skew()
print('Blood pressure skewness = '+str(blood_pressure_skewness))
# c: obesity is not the thing here
```

```
Blood pressure median = 72.0
```




```
Blood pressure skewness = 0.13445955512111737
```